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Original Article

# Management for locking compression plate/ dynamic compression plate implant failure in non union osteoporotic humerus shaft bone fracture

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ABSTRACT

*Introduction:* To introduce the experience of treating nonunion osteoporotic of humeral fractures with interlocking nailing for failed surgical treatment by plating. Etiology for non-union after failed surgical management of humeral shaft fractures is multi-factorial. Following factors may play a role in nonunion – inadequate fracture fixation with poor contact between the fracture segments, osteomalacia, osteoporosis, infection, devitalization of bone and many more.

*Materials and methods:* A retrospective comparative study of twenty four patients who had locking compression plate failure in osteoporotic humerus shaft fractures treated with interlocking nail and iliac crest bone graft at Gandhi Hospital from 2007 to 2010.

*Results:* Twenty extremities had a return to nearly normal function within twelve weeks after nailing. According to Rommens criteria excellent results seen in 79.2%, moderate 16.7%, poor 4.1%. The mean Constant-Murley score improved from pre operative 45.9 ± 17.6 to 79.1 ± 12.6 ($p < 0.001$) post operative.

*Conclusion:* Interlocking intramedullary nailing of the humerus provides immediate stability and can be accomplished with a closed technique, brief operative time, and minimum morbidity, with a resultant early return of function to the extremity.

**LEVEL OF EVIDENCE**: iii retrospective cohort study.



## 1. Introduction

Osteoporotic humeral nonunion resulting after operative intervention of plate fixation presents a different set of problems like broken or loosened implants, scarred tissues, avascular bone ends and sometimes deep seated infection.[1,2] Loosened screws cause osteolysis at the hole sites and loss of local bone substance. The cortex underneath the plate becomes sclerotic and avascular. In such a complicated condition replating becomes even more difficult and enough stability may not be achieved. In addition, dissection and periosteal damage further decreases the viability of the bone ends and puts radial nerve at a high risk of injury. The major technical problem the surgeon faces is the difficulty to produce secure fixation of the implant to the bone. The common mode of failure of internal fixation in osteoporotic bone is bone failure rather than implant breakage. Rosen has defined a

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delay of 3–4 months inbony healing as a delayed union and a delay of 6–8 months as a non-union.[3]

The high rate of complications has encouraged extensive research into the development of implants that improve the bone-implant interface by preventing high bone strain and distributing the force to the bone in a load-sharing rather than load-bearing configuration. Intramedullary nails are load sharing and provide relative stability. They seem to be the most efficient method of reducing strain at the bone-implant interface. Cancellous or corticocancellous bone autografts to assist fracture healing are probably still the best.

## 2. Materials & methods

A retrospective study of Twenty four cases of failure fixation in non union osteoporotic fracture shaft humerus, were stabilised with the interlocking nail and iliac crest bone graft.[1,2,4–7] There were 10 male {41.66%) and 14 female (58.33%) patients. All patients (Table 2) had atrophic nonunion of the humerus except two. The right side was affected in 14 cases [58.3%], and left 10 cases [41.7%]. The nonunion was in the upper third of the humerus diaphysis in four cases (16.6%), middle third in 18 cases [75%), and lower third in two cases (8.3%). The original fracture was close in 20 cases (83.3% and open in 4 cases (16.7%). In 4 cases (16.7%), there was history of infection after the index surgery, however, active infection was controlled by debridement and antibiotics. Autogenous Iliac crest bone graft (ICBG) was performed in all cases. Our inclusion criteria are all patient older than 50 year with failed surgical fixation. Our exclusion criteria are fresh fracture and young patient. All surgery were performed by single surgeon. Average duration of surgery is one hour. All women and men older than 50 years with low energy fracture were subjected to BMD testing. The gold standard method is DEXA scan {dual energy X-ray absorptiometry}.In our study hip, spine, forearm were evaluated. In our study average mean T-score is −2.5, serum vitaminD3 level is <50 nmol/L (<20 ng/mL) at 1st surgery (Table 3).

### 2.1. *Operative procedure: interlocking nail*

The previous operative scar was used to approach the fracture site. Implant removal is done. Debridement of non union site is done followed by trimming and decortications of bone ends were done.[1,2,4] A longitudinal skin incision is made from the most lateral point of the acromion. Using the small curved awl, the entry portal is established, Interloking nail is inserted, proximal and distal locking was done. Anterior iliac crest bone grafts were used in all cases.

Post Operative Care.

- Antibiotics i.v for 3 days
- Universal shoulder immobiliser is given
- Suture removal on 10th day
- Assisted active ROM exercises for wrist & hand from 1st post operative day
- Active assisted shoulder & elbow exercises started after 2 weeks
- 5 mg Zoledronic acid infusion was given two weeks after surgery followed by yearly once for three years with maintenance calcium citrate 500 mg once a day. It should be given two weeks after surgery because delay dosing would potentially increase the quantity of zoledronic acid binding to the target area, leading to a greater anti catabolic effect with the same dose. Second delayed administration would allow the initial endogenous anabolic and catabolic response to establish themselves before dose administration. Zoledronic acid administered as a 5 mg intravenous infusion annually increases bone mineral density in the lumbar spine and femoral neck by 6.7% and 5.1% respectively and reduces the incidence of new vertebral and hip fractures by 70% and 41%. Most common side effects are post-dose fever, flu-like symptoms, myalgia, arthralgia, and headache which usually occur in the first 3 days after infusion and are self-limited. Rare adverse effects include renal dysfunction, hypocalcemia, atrial fibrillation, and osteonecrosis of the jaw.

**Table 1 – Postoperative complications.**

| Complication | No. of cases | % (in comparison to all cases) |
|---|---|---|
| **Immediate** | | |
| Superficial Infection | 1 | 4.1 |
| **Delayed** | | |
| Shoulder Dysfunction | 4 | 16.6 |
| Non Union | 1 | 4.1 |

**Table 2 – Final results According to Rommen's criteria.**

| Result | No. of cases | % |
|---|---|---|
| Excellent | 19 | 79.2 |
| Moderate | 4 | 16.7 |
| Poor | 1 | 4.1 |

## 3. Results

There were 24 cases with mean age of 63.29 years.

The mean time of radiological bone healing was 4.2 months (range three to seven months). Sound bone healing was achieved in all cases except one (4.1%). Result of case1 was shown in Fig. 1a, b, c.The number of cases available for follow up is twenty four and duration of follow up is eighteen months. According to the to Rommen's Criteria, the functional outcome was excellent in 19cases (79.2%), moderate in four cases (16.7%), poor in one case [4.1%] which was treated by Ilizarov ring fixator. There were no cases of iatrogenic nerve or vascular injury due to surgery. There was good relief of pain within two weeks after nailing procedures and excellent relief after five weeks. All patients had improvement in the functional use of the extremity after fixation. No patient noted any limitation of motion of the elbow. The range of motion of the shoulder was documented numerically for eleven patients, who had a mean of 101° (range, 55–180°) of abduction and 98° (range, 45–170°) of forward flexion. Nine other patients had a full range of motion